

General Public Awareness of Sources of Radiation in Their Environment¹

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Abstract. A telephone survey (poll) of randomly selected Ohio citizens was conducted to determine their awareness and knowledge of sources of radiation in their environment. During October 1992, 1,450 households were contacted resulting in 879 complete interviews. Nearly half of those Ohio citizens surveyed have heard something about disposal of low-level radioactive waste. Knowledge about radiation exposure and sources was found to be related to general education level. College graduates tend to be slightly more aware of sources and exposure than adults with less than a high school education. Radiation exposure from bricks used in buildings, flying in an airplane, and smoke detectors was identified by fewer than 20% of respondents overall.

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INTRODUCTION

Low-level radioactive waste (LLRW) from nuclear power plants, industries, research facilities, and hospitals in Ohio has been transported to a disposal facility in Barnwell, SC. Beginning 1 July 1994, waste from Ohio was no longer accepted at the Barnwell facility. Ohio is not alone. With the passage of the Low-Level Radioactive Waste Policy Act in 1980, state governments have been encouraged to form multistate compacts that can operate a LLRW waste disposal facility and exclude waste from outside the compact. Ohio became a part of the Midwest Interstate Low-Level Radioactive Waste Compact in 1984 and was designated as the host state for the disposal facility in 1991. Responsibility for hosting the disposal facility will rotate among the Midwest Compact member states with each state serving as host for 20 years.

The people of Ohio must decide where and how to dispose of low-level radioactive wastes. Unfortunately most citizens and local officials are unfamiliar with low-level radioactive waste and are not fully prepared to discuss options for storage and disposal. Citizens of Ohio need information on LLRW to make sound decisions. Vonkeman (1990) pointed out that public education is different from public relations. The public must have access to all information and they need to have an opportunity to formulate questions and opinions about upcoming decisions. Vonkeman also noted that approaching the public as an uninformed, non-expert group and offering it interpretations and results rather than basic data and facts is a serious mistake. To address this educational need, The Ohio State University Nuclear Engineering program and The Ohio State University Extension initiated a statewide educational program.

The first and most critical step in developing an educational program for a technical and emotional topic like low-level radioactive waste management is a determination of the current knowledge, attitudes, beliefs, and misconceptions of the public. Morgan and others (1992) suggested that independent knowledge of the

fundamentals of an issue provides individuals with the basis for evaluating "experts' pronouncements." They further pointed out the need for teachers to know the nature and extent of the audience's knowledge and beliefs in designing an educational program "that will not be dismissed, misinterpreted, or allowed to coexist with misconceptions." DeMarchi (1990) suggested that just asking people what they need to know is meaningless. Needs do not emerge through an opinion survey. Rather the investigator must discover how people organize information.

Bostrom and others (1992) argued that people do not need to know "summary estimates, but rather substantive knowledge of what a hazard is and how it works." Knowledge of a hazard is essential for public discussions and formulation of opinions as a focus for decision making. Bostrom's group identified the first task for an educator to be determination of current beliefs about a technology and examination of the gaps in knowledge.

In 1992, efforts were made to assess the knowledge, attitudes, and beliefs of Ohio citizens pertaining to radiation. An objective of the present study was to determine Ohioans' awareness and knowledge of sources of radiation in their environment.

MATERIALS AND METHODS

A telephone survey or poll of randomly selected Ohio households was conducted in October 1992 to collect information on knowledge of radiation sources. A sample of households throughout Ohio was selected by random digit dialing. Adults (age 18 or older) living in the household were surveyed. The telephone survey was conducted by interviewers at the University of Cincinnati Institute for Policy Research. Between 16 and 25 October 1992, a total of 1,450 households were contacted. Of these contacts, 60.6% resulted in fully completed interviews, and 4.3% resulted in partially completed interviews. Refusals accounted for 11.3%. Failures to interview because of language barriers, hearing problems, senility, illness, or illiteracy accounted for 5.2%. Failures to interview because the respondent was unavailable accounted for 18.6%.

As a part of the interview, respondents were asked three sets of questions concerning their knowledge of

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radiation in their environment. In addition, they were asked to describe their educational level as being in one of four categories: less than high school, high school graduate, some college, or college graduate. The questions on radiation in the environment were:

- How much would you say you have seen or heard about low-level radioactive waste or the disposal of low-level radioactive waste—a great deal, some, or not much?
- Please tell me if you agree or disagree with the following statements.

You get radiation exposure:

- by sunbathing.
- from flying on an airplane.
- from a chest x-ray.
- from bricks used to build brick homes.
- from the fallout of nuclear weapons testing.

All of these activities result in radiation exposure; therefore, agree is the correct response to each question.

- Please tell me if you agree or disagree with the following statements.

- Uranium is a source of radiation.
- Radon is a source of radiation.
- Ash from coal plants is a source of radiation.
- Smoke detectors are a source of radiation.
- Low-level radioactive waste disposal facilities are a source of radiation.

All are sources of radiation; therefore, agree is the correct response to each question.

A small degree of participation bias was recognized in this sampling technique. Some demographic groups were under-represented due to the fact that they did not have a telephone or chose not to respond to the survey. For example, male respondents were under-represented when compared to the 1980 U.S. Census by about 5%. Weighting variables were applied to the data sets to account for sampling bias due to gender, age, race, education, and county of residence.

The significance of data trends was measured using the Kruskal-Wallis test. The Kruskal-Wallis test is well suited to measure the degree to which various sums of ranks differ (Blalock 1960).

RESULTS

Most of the respondents to the survey (45%) were high school graduates. Twenty-three percent had not graduated from high school. Some college education was reported by 16% and the remaining 16% were college graduates.

About half of the respondents (53%) had heard at least some information about the disposal of low-level radioactive waste. The information response was positively related to educational level, with more college graduates indicating that they had heard about disposal than those who did not complete high school (Fig. 1). The test confirmed a positive ranking of awareness of low-level radioactive waste disposal with educational level of adults in Ohio ($P < 0.044$).

Many survey respondents were unaware of routine exposure to radiation from natural sources (Fig. 2A,B). Overall, only 14% agreed with the statement that flying

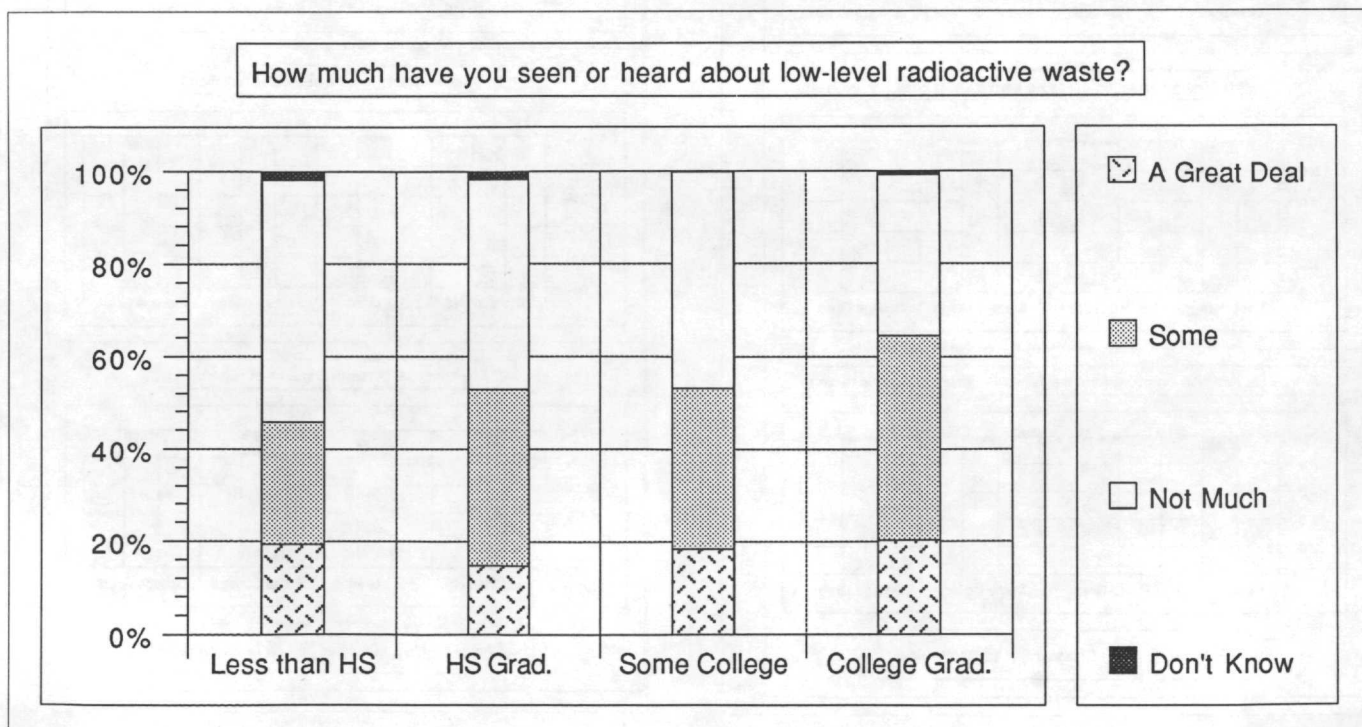


FIGURE 1. Results of 892 responses to telephone survey question on amount seen or heard about low-level radioactive waste by educational level.

in an airplane is a source of radiation exposure. Also, only 13% overall agreed that bricks used in building homes was a source of radiation exposure. Most respondents were aware of radiation exposure from sunbathing (76%) and chest x-ray (90%) (Fig. 2C,D). Responses to all the questions on exposure were positively

related with educational level ($P < 0.00004$). Knowledge of radiation exposure from nuclear weapons testing fallout was noted by 93% of respondents. However, more college graduates disagreed that fallout was a source of exposure than the groups with less formal education (Fig. 2E).

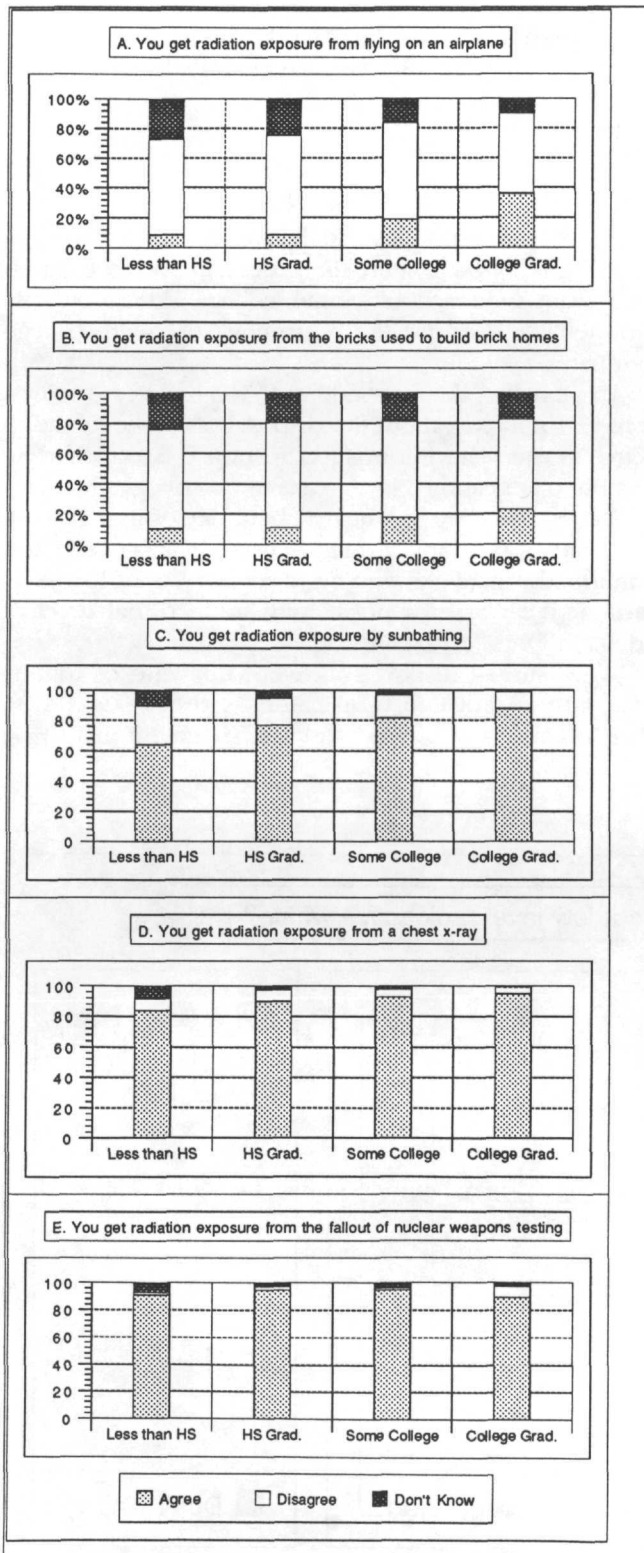


FIGURE 2. Results of 892 responses to telephone survey questions on radiation exposure by educational level.

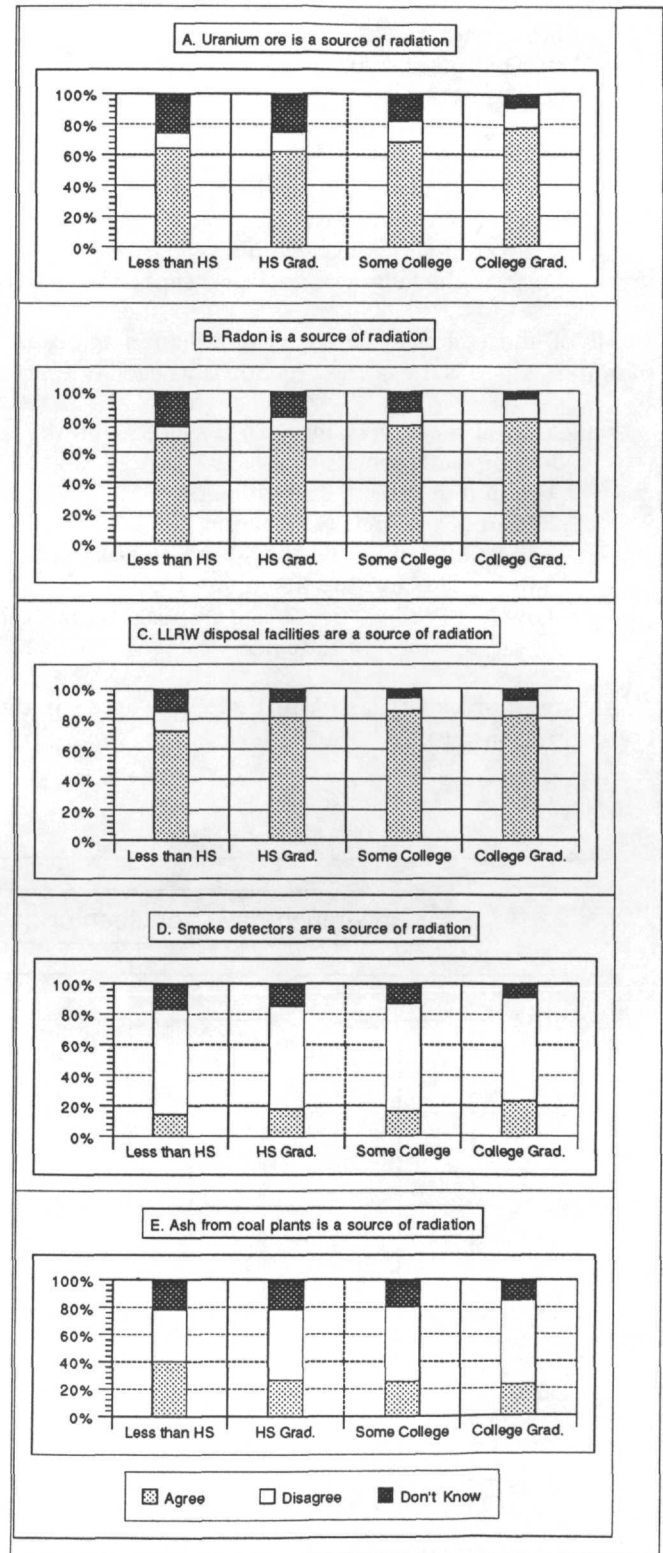


FIGURE 3. Results of 892 responses to telephone survey questions on radiation sources by educational level.

The radioactive materials of uranium ore, radon, and low-level radioactive waste were all identified as radiation sources by a majority of respondents (Fig. 3A,B,C). Surprisingly, only 66% of survey respondents agreed that uranium ore was a source of radiation. Most respondents agreed that low-level radioactive waste (79%) and radon (74%) were sources of radiation. By contrast, only 18% of respondents recognized a widespread commercial use of radioactive materials in smoke detectors (Fig. 3D). Knowledge of the four radiation sources had a positive relationship with educational level ($P < 0.0004$).

Ash from coal plants was recognized by 29% of respondents as a radiation source (Fig. 3E). Surprisingly, the identification of ash as a radiation source was inversely related with educational level ($P = 0.001$). More people with less than a high school education recognized this source than college graduates.

DISCUSSION

As an educational program on low-level radioactive waste disposal is developed in Ohio, it must take into account the present knowledge of the public concerning radiation issues. The results of this survey can be used to describe the knowledge and beliefs of adults in Ohio. Most Ohioans have heard something about low-level radioactive wastes and know something about radiation sources. This fact must be shared and reinforced.

Knowledge of sources of radiation exposure is positively correlated with educational level. College graduates were aware of more sources than adults who had not graduated from college. A striking exception to this conclusion was the knowledge that ash from coal plants is a source of radiation. People with lower educational levels were more aware of this source.

Respondents were most acutely aware of radiation exposure from sunbathing, chest x-ray, and nuclear

weapons testing. All of these sources can either be controlled or are voluntary.

Misconceptions must also be noted and corrected. Most respondents were not aware that common activities, such as air travel and occupying a brick building, are a source of radiation exposure. Also most respondents were not aware of a frequent commercial source of radiation in household smoke detectors. Misinformation about radiation sources crosses all educational levels. Therefore, all adults in Ohio should benefit from increased information on radiation principles. The educational materials, however, must be useful to and directed to people of all educational levels.

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